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Skrzypchak et al.

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(54) **BATTERY CONNECTION SYSTEM FOR AN OUTBOARD ENGINE**

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(51) **Int. Cl.**

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H01R 13/46	(2006.01)
B63H 20/32	(2006.01)
B63H 20/14	(2006.01)
F02N 11/14	(2006.01)

(52) **U.S. Cl.**

CPC ***B63H 21/21*** (2013.01); ***B63H 20/14*** (2013.01); ***B63H 20/32*** (2013.01); ***F02N 11/14*** (2013.01); ***H01R 13/46*** (2013.01); *B63H 2021/216* (2013.01)

(58) **Field of Classification Search**

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USPC 440/83
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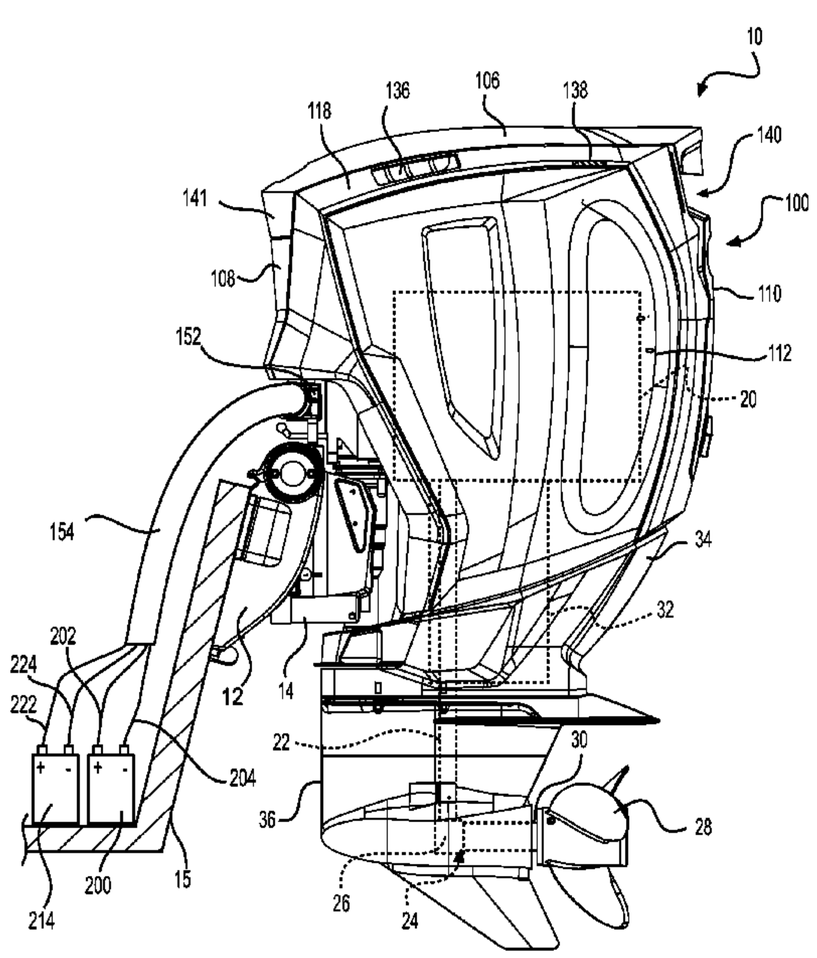
(57) **ABSTRACT**

An electrical system for an outboard engine has a generator, a starter motor, a connector having first, second and third connector terminals, the first connector terminal being connected to the generator, the second connector terminal being connected to the starter motor, and the third connector terminal being connected to ground, and a cap connected to the connector. The cap has a first cap terminal connected to the first connector terminal and a second cap terminal connected to the second connector terminal. The first cap terminal is connected to the second cap terminal. An electrical system having a battery connected to the connector instead of the cap is also disclosed. An outboard engine having the system is also disclosed.

18 Claims, 9 Drawing Sheets



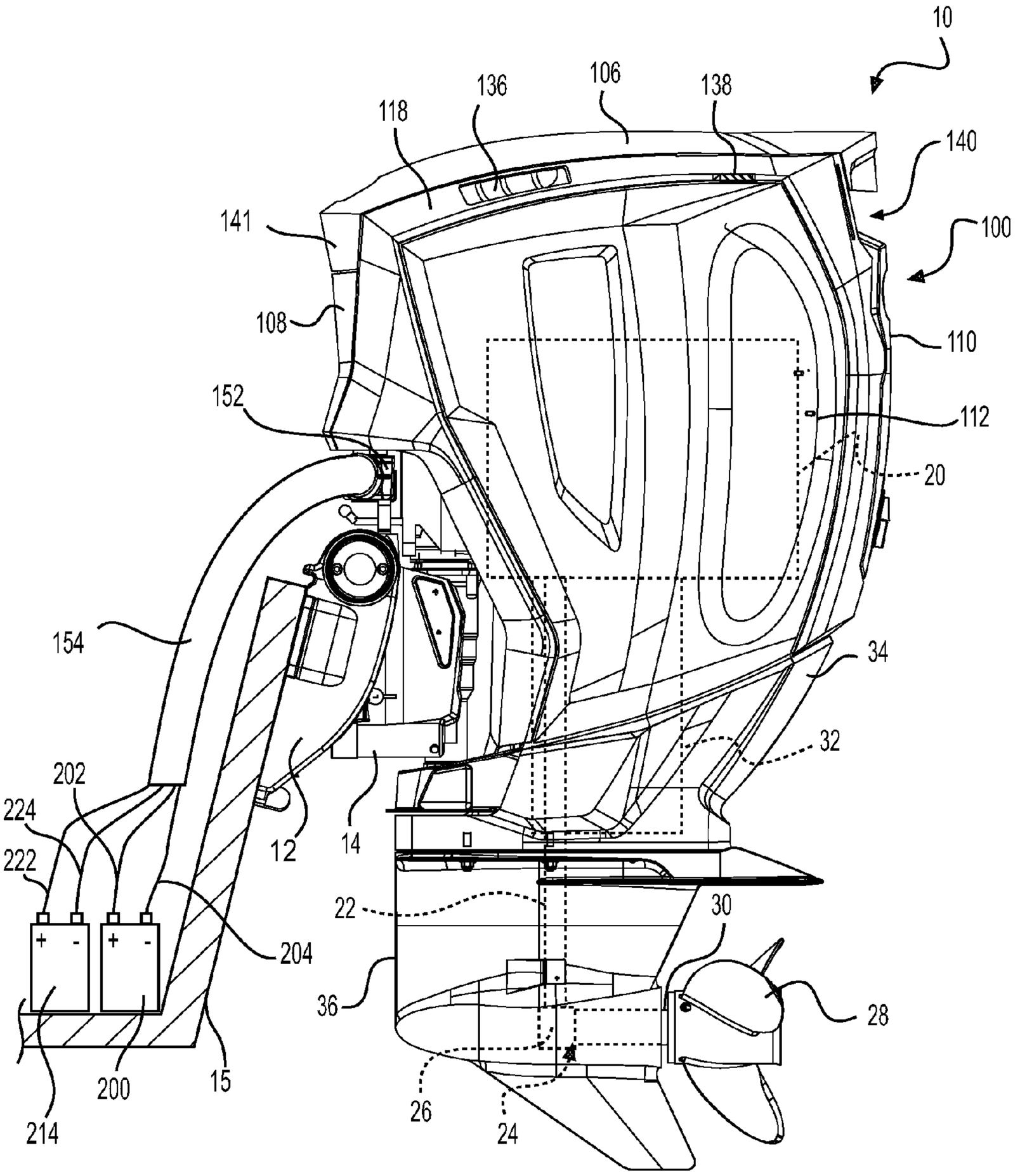

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FIG. 1

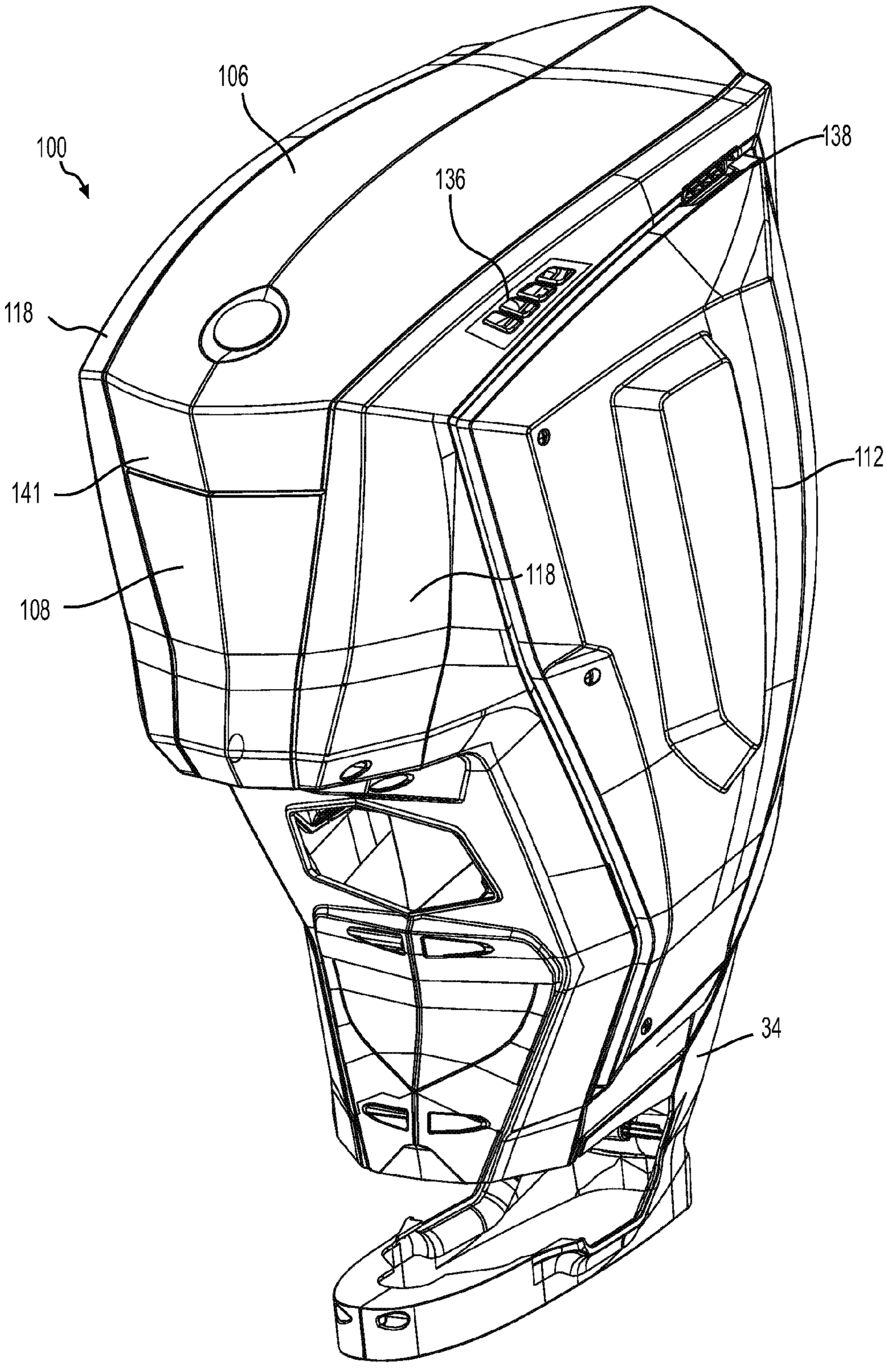

FIG. 2

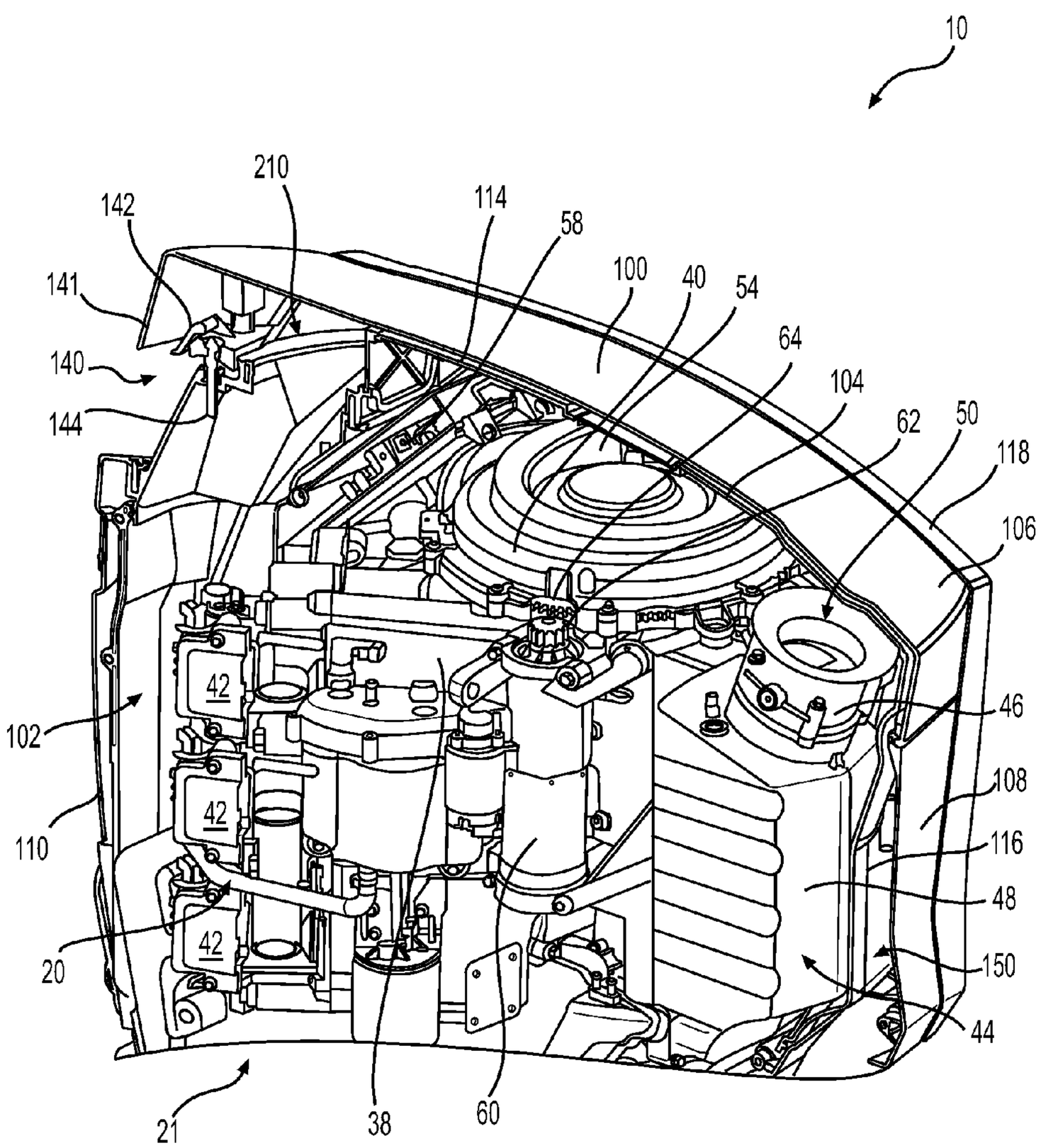
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FIG. 3

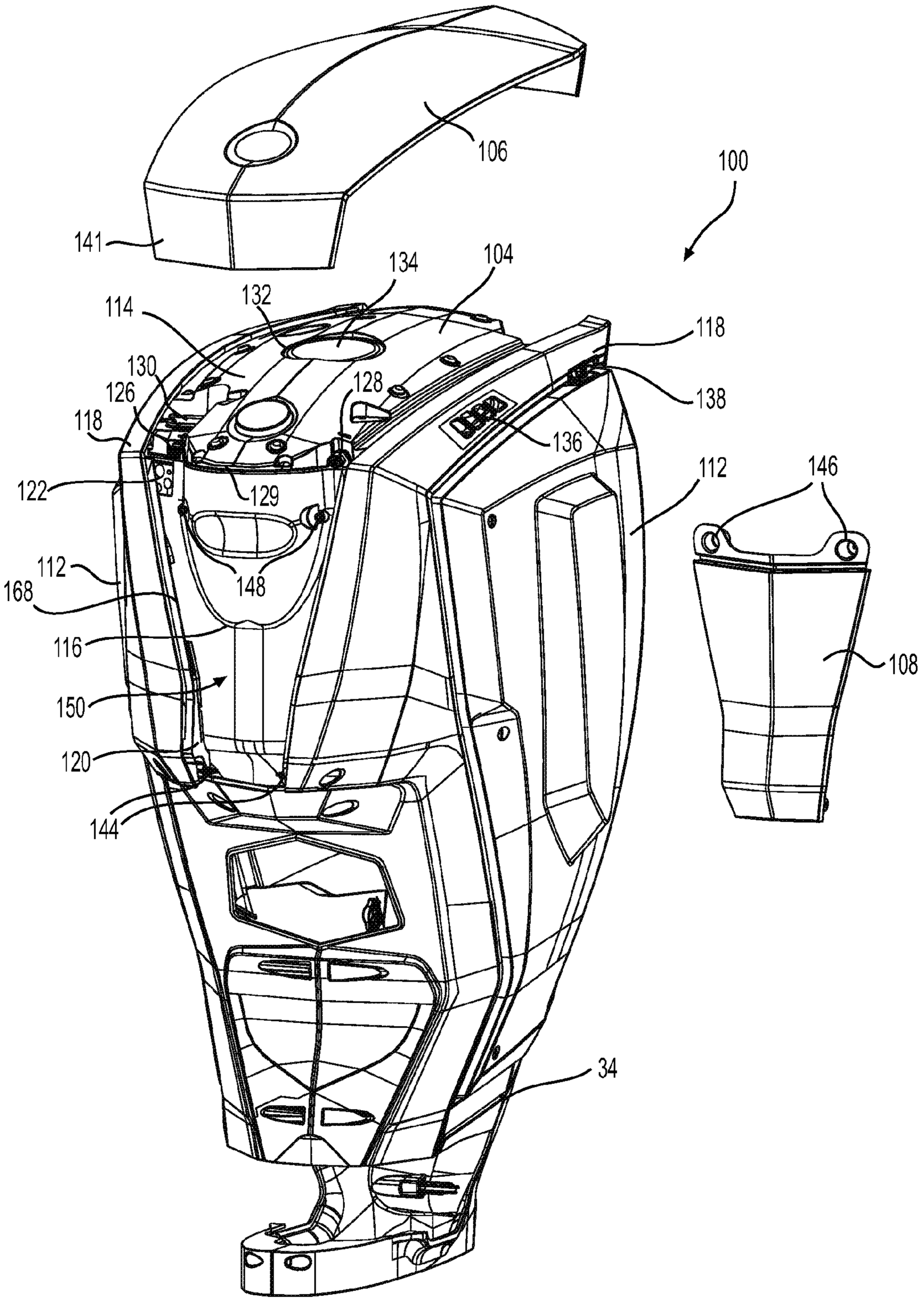
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FIG. 4

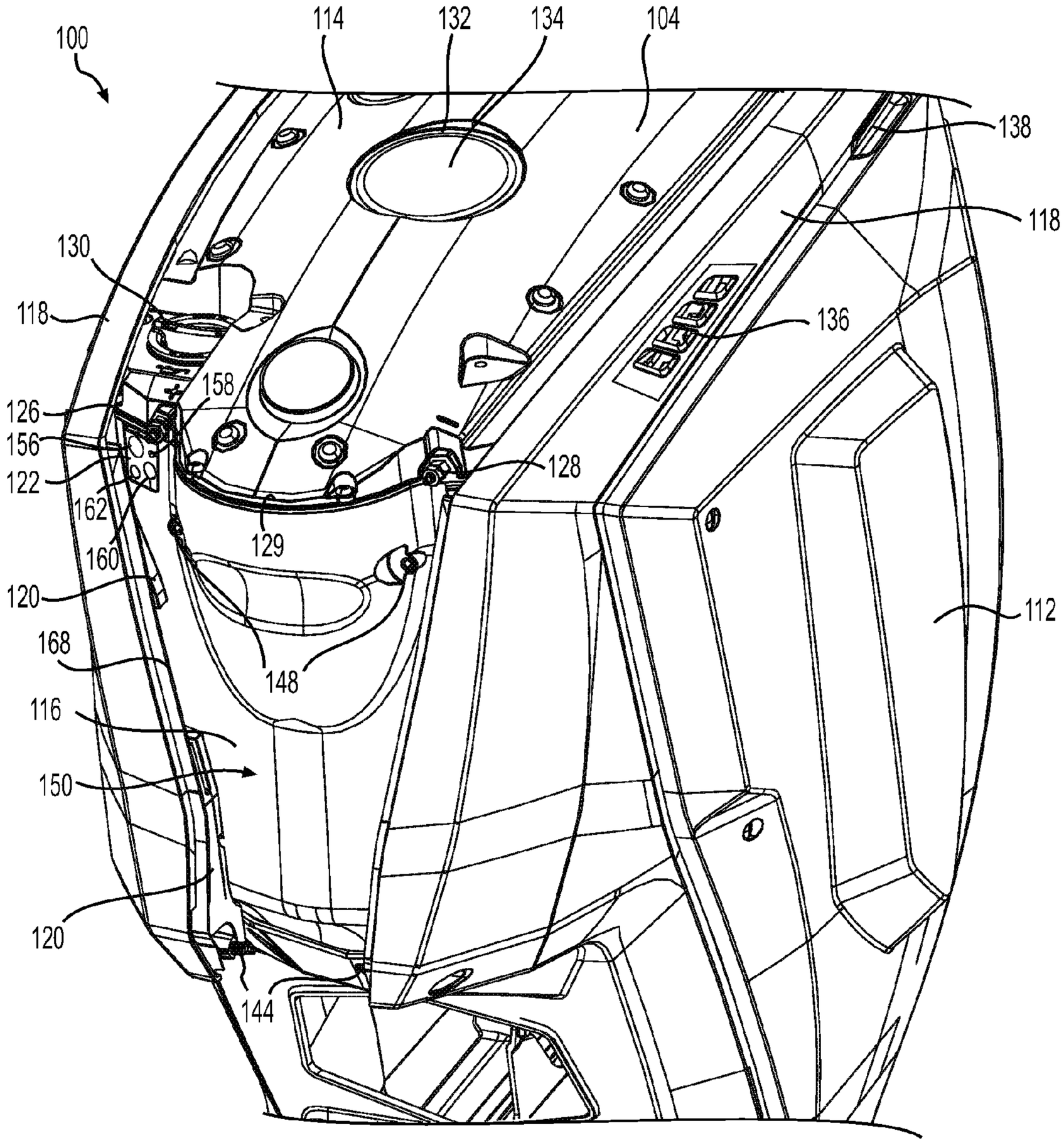
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FIG. 5

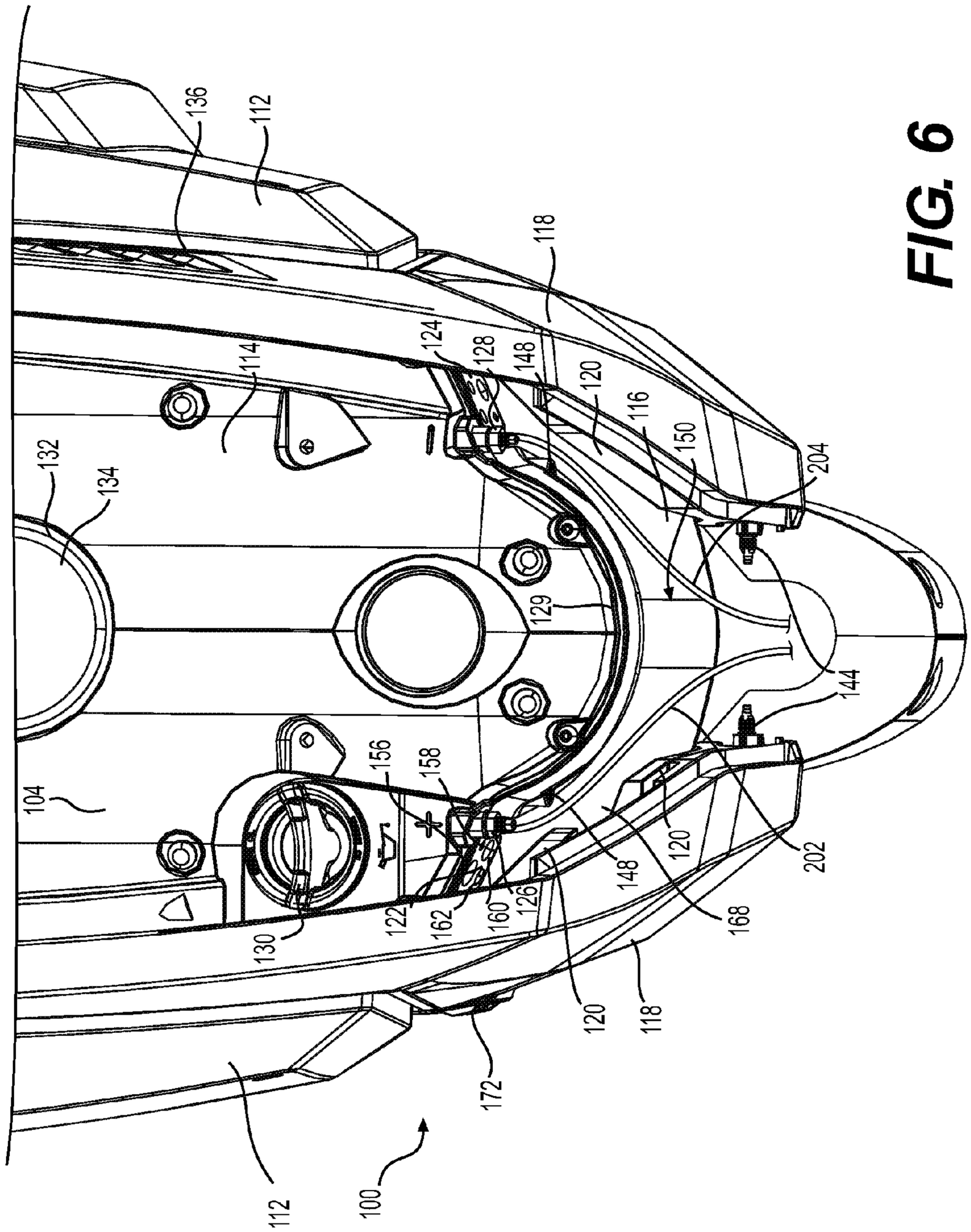
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FIG. 6

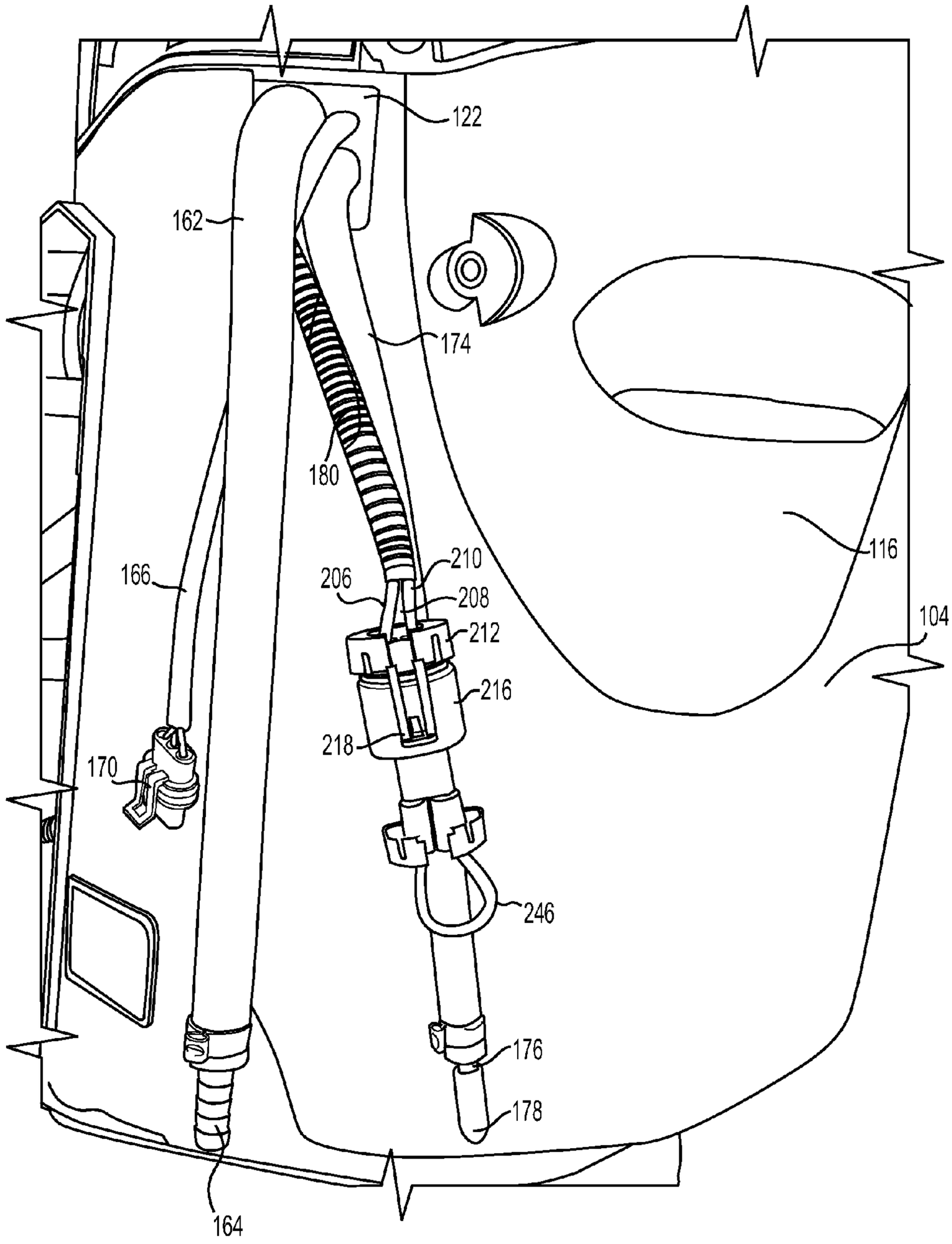
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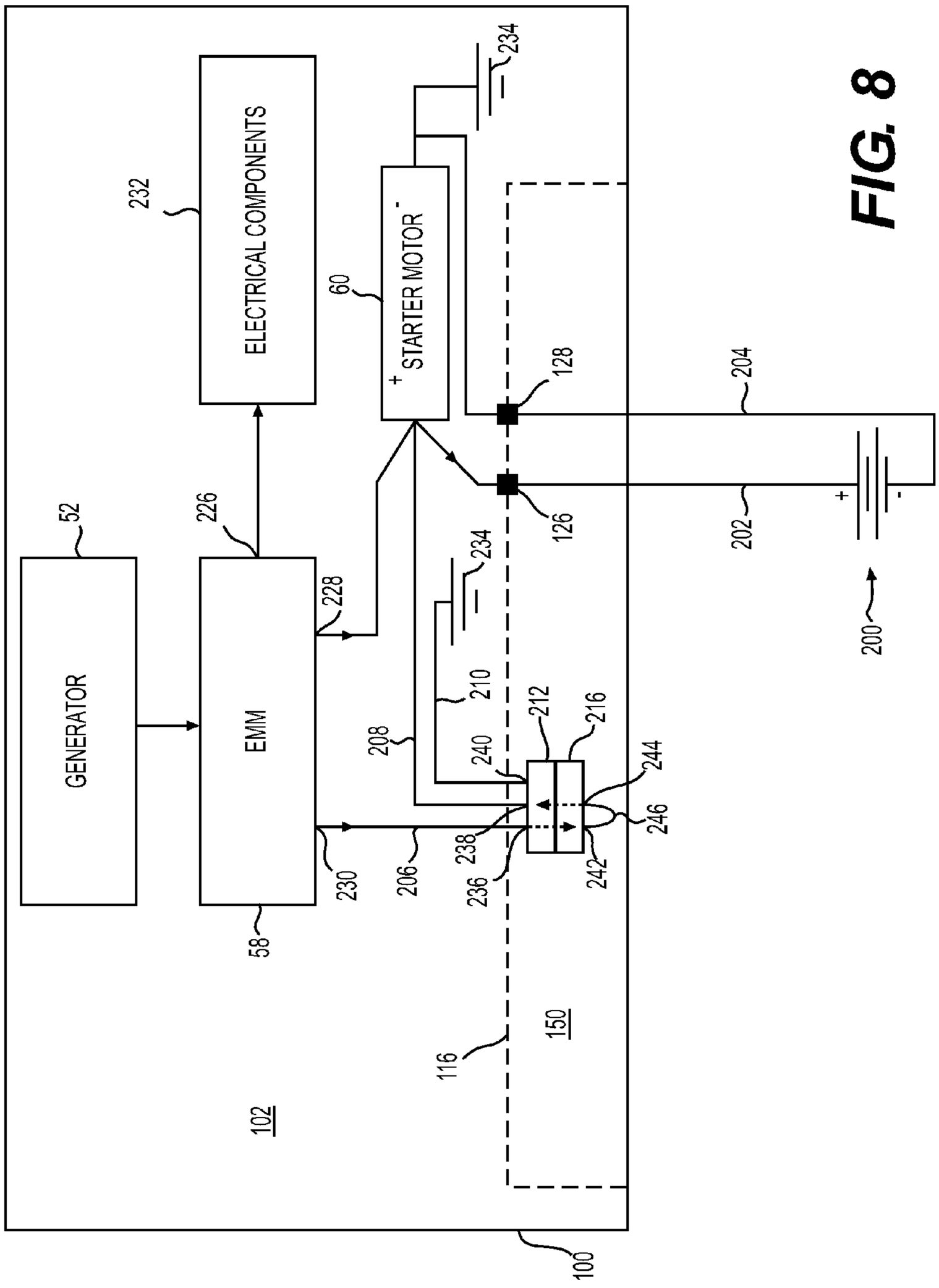
FIG. 7


GENERATOR
52
EMM
58
226
228
ELECTRICAL COMPONENTS
232
STARTER MOTOR
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128
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212
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102
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FIG. 8

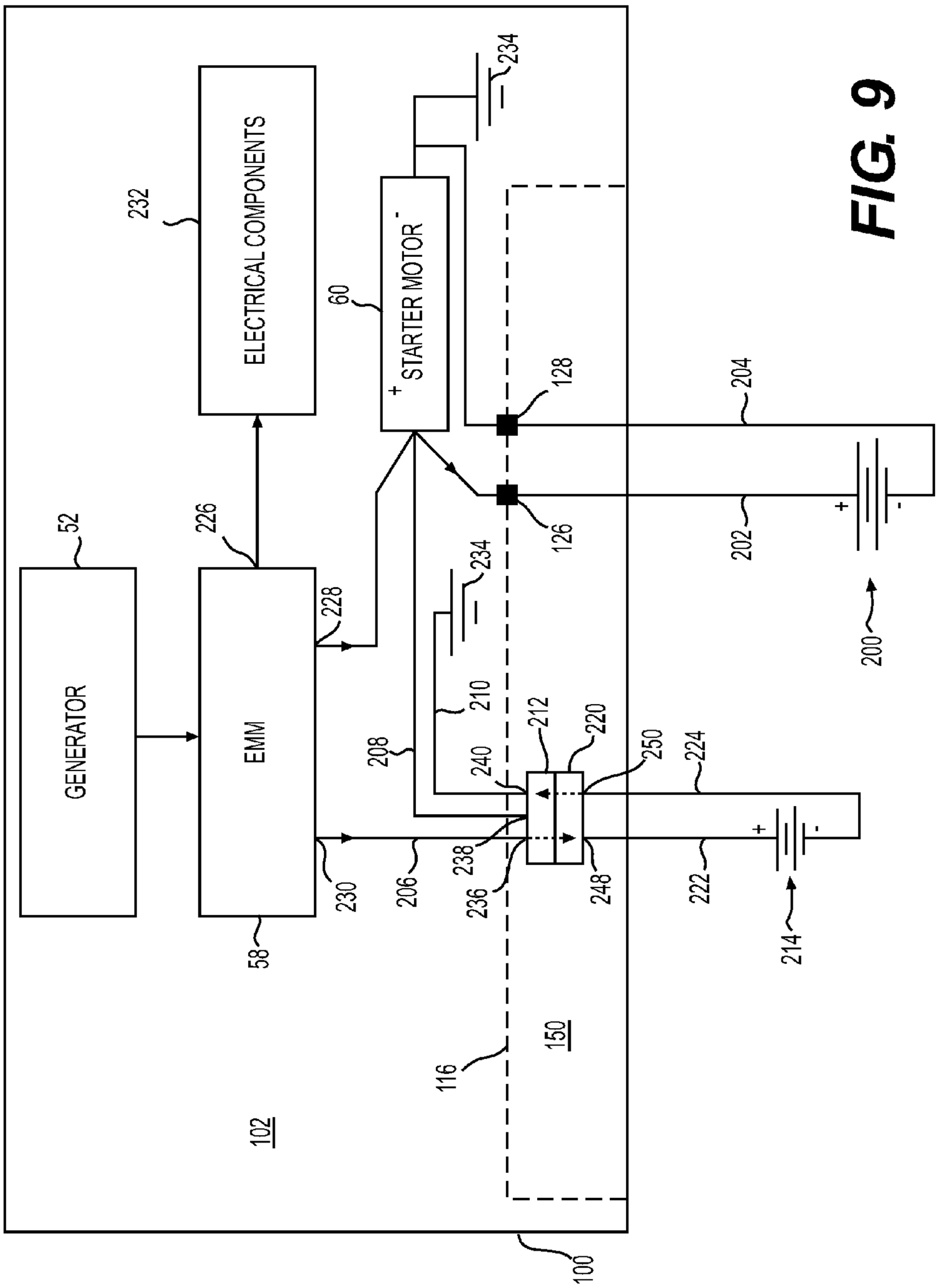
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FIG. 9

BATTERY CONNECTION SYSTEM FOR AN OUTBOARD ENGINE

FIELD OF TECHNOLOGY

The present technology relates to a system for connecting a battery to an outboard engine.

BACKGROUND

Marine outboard engines can typically be started using a recoil starter or using an electric starter. In outboard engines having a recoil starter, the user pulls on a rope which causes the engine's crankshaft to turn and which, if successful, permits the starting of the engine. In outboard engines having an electric starter, electric power is supplied to a starter motor which engages a gear connected to the crankshaft. As a result, the motor turns the gear, which turns the crankshaft, which permits the starting of the engine. Once the engine has started, the starter motor disengages the gear and power is no longer supplied to the starter motor. Some outboard engines having an electric starter are also provided with a recoil starter as a backup to the electric starter.

In marine outboard engines having an electric motor, a battery is connected to the starter motor in order to supply electric power to the starter motor. As the space inside the cowling of the outboard engine is limited, the battery is usually located outside of the cowling such as in the stern portion of the boat to which the outboard engine is mounted. As such, cables run from the battery to a control module inside the cowling. The control module is connected to the starter motor and controls the supply of electric power to the starter motor.

The engine of the outboard engine drives a generator, such as a magneto or an alternator, which generates electricity as it turns. This electricity is used to operate the various electric components of the engine, such as the fuel injectors and spark plugs, but also to recharge the battery.

Some boats propelled by an outboard engine are also provided with one or more other batteries to power various accessories of the boat such as, for example, a trolling motor, a fish finder, a GPS, live wells, a refrigerator, bilge pumps and a sound system. In such arrangements, the battery described above used for starting the engine is referred to as the primary or main battery and the one or more batteries used to power the accessories is referred to as auxiliary or house batteries. The auxiliary batteries are also sometimes used as a backup to the primary battery in order to supply power to the starter motor. The one or more auxiliary batteries are also disposed in the boat. In order to be recharged by the outboard engine, the one or more auxiliary batteries also have to be connected to the generator of the outboard engine.

In some outboard engines, the primary and auxiliary batteries are connected to a switch disposed in the boat and which is connected to the generator. The switch has three positions. In one position of the switch, only the primary battery is connected to the generator. This position is selected when starting the engine for example. In another position of the switch, only the auxiliary battery is connected to the generator. This position is selected when the engine is stopped and accessories need to be powered for example. In another position of the switch, both the primary and auxiliary batteries are connected to the generator. This position is selected when the engine is running, accessories need to be powered by the auxiliary battery and the primary battery needs to be charged for example. As such, the user needs to manually select the proper switch position. This could lead the user to select the wrong position resulting possibly in one or more of the batteries being drained.

In some outboard engines, a controller is associated with the switch to automatically select the proper position of the switch based on power requirements and charge levels.

Some outboard engines are only provided with the primary battery but provide the option of connecting an auxiliary battery. In one embodiment of such an outboard engine, the generator is connected to an engine management module (EMM) having a main output and an auxiliary output. The main output is connected to the primary battery via the starter motor. When no auxiliary battery is provided, the auxiliary output is connected to a first connector which is connected to a second connector which connects to the starter motor. In order to connect and auxiliary battery, the first connector is disconnected from the second connector and is instead connected to a third connector connected to the battery. As a result, the generator is connected to the auxiliary battery via the auxiliary output of the EMM and the first and third connectors. A cap is connected to the second connector.

Although the above facilitates the installation of an auxiliary battery, it has some inconveniences. The first and second connectors are disposed inside the engine compartment defined by the cowling of the outboard engine. Therefore, in order to disconnect the first connector from the second connector, the cowling needs to be removed at least in part in order to access the connectors. Also, the third connector needs to be routed through the cowling to the first connector. Also, the first, second and third connectors take up space in the already confined engine compartment. Finally, when the third connector is connected to the first connector when an auxiliary is provided, the second connector serves no function and just takes up space in the engine compartment.

Therefore, there is a desire for a system that facilitates the connection of an auxiliary battery to an outboard engine.

SUMMARY

It is an object of the present technology to ameliorate at least some of the inconveniences present in the prior art.

According to one aspect of the present technology, there is provided an electrical system for an outboard engine having a generator, a starter motor electrically connected to ground, a connector having first, second and third connector terminals, the first connector terminal being electrically connected to the generator, the second connector terminal being electrically connected to the starter motor, and the third connector terminal being electrically connected to ground, and a cap connected to the connector and covering at least the first and second connector terminals, the cap having first and second cap terminals, the first cap terminal being electrically connected to the first connector terminal, the first cap terminal being electrically connected to the second cap terminal, and the second cap terminal being electrically connected to the second connector terminal.

In some implementations of the present technology, a battery is electrically connected to the starter motor and the second connector terminal.

In some implementations of the present technology, an engine management module (EMM) is electrically connected to the generator and to the first connector terminal. The generator is electrically connected to the first connector terminal via the EMM.

In some implementations of the present technology, the EMM is electrically connected to the first connector terminal by a first connection. The EMM is electrically connected to the starter motor by a second connection.

In some implementations of the present technology, the generator is electrically connected to the starter motor via the EMM and the second connection.

According to one aspect of the present technology, there is provided an outboard engine having an internal combustion engine, a driveshaft operatively connected to and driven by the engine, a propeller shaft operatively connected to and driven by the driveshaft, a propeller connected to and driven by the propeller shaft, and the electrical system according to one of the above implementations. The generator is connected to and driven by the engine. The starter motor is selectively operatively connected to the engine for starting the engine.

In some implementations of the present technology, a cowling defines an engine compartment. The engine, the generator and the starter motor are disposed in the engine compartment. The connector and the cap are disposed outside the engine compartment.

In some implementations of the present technology, the cowling defines a rigging area. The connector and the cap are disposed in the rigging area.

In some implementations of the present technology, a battery is electrically connected to the starter motor. The battery is disposed outside of the cowling.

According to one aspect of the present technology, there is provided an electrical system for an outboard engine having a generator, a starter motor electrically connected to ground, an engine-side connector having first, second and third engine-side connector terminals, the first engine-side connector terminal being electrically connected to the generator, the second engine-side connector terminal being electrically connected to the starter motor, and the third engine-side connector terminal being electrically connected to ground, a battery-side connector connected to the engine-side connector and covering the first, second and third engine-side connector terminals, the battery-side connector having first and second battery-side connector terminals, the first battery-side connector terminal being electrically connected to the first engine-side connector terminal, and the second battery-side connector terminal being electrically connected to the third engine-side connector terminal, and a battery having a first terminal electrically connected to the first battery-side connector terminal and a second terminal electrically connected to the second battery-side connector terminal.

In some implementations of the present technology, the battery is a first battery. A second battery electrically connected to the starter motor.

In some implementations of the present technology, an engine management module (EMM) is electrically connected to the generator and to the first engine-side connector terminal. The generator is electrically connected to the first engine-side connector terminal via the EMM.

In some implementations of the present technology, the EMM is electrically connected to the first engine-side connector terminal by a first connection. The EMM is electrically connected to the starter motor by a second connection.

In some implementations of the present technology, the generator is electrically connected to the starter motor via the EMM and the second connection.

According to one aspect of the present technology, there is provided an outboard engine having an internal combustion engine, a driveshaft operatively connected to and driven by the engine, a propeller shaft operatively connected to and driven by the driveshaft, a propeller connected to and driven by the propeller shaft; and the electrical system according to one of the above implementations. The generator is connected to and driven by the engine. The starter motor is selectively operatively connected to the engine for starting the engine.

In some implementations of the present technology, a cowling defines an engine compartment. The engine, the generator and the starter motor are disposed in the engine compartment. The engine-side connector, the battery-side connector and the battery are disposed outside the engine compartment.

In some implementations of the present technology, the cowling defines a rigging area. The engine-side connector and the battery-side connector are disposed in the rigging area.

In some implementations of the present technology, the battery is a first battery. A second battery is electrically connected to the starter motor. The first and second batteries are disposed outside of the cowling.

According to one aspect of the present technology, there is provided a method for connecting a second battery to an outboard engine. The second battery has a first terminal electrically connected to a first battery-side connector terminal of a battery-side connector and a second terminal electrically connected to a second battery-side connector terminal of the battery-side connector. The outboard engine has an internal combustion engine, a driveshaft operatively connected to and driven by the engine, a propeller shaft operatively connected to and driven by the driveshaft, a propeller connected to and driven by the propeller shaft. A generator is connected to and driven by the engine. A starter motor is selectively operatively connected to the engine for starting the engine and electrically connected to ground. An engine-side connector has first, second and third engine-side connector terminals. The first engine-side connector terminal is electrically connected to the generator. The second engine-side connector terminal is electrically connected to the starter motor. The third engine-side connector terminal being electrically connected to ground. A cap is connected to the engine-side connector and covers at least the first and second engine-side connector terminals. The cap has first and second cap terminals. The first cap terminal is electrically connected to the first engine-side connector terminal. The first cap terminal is electrically connected to the second cap terminal. The second cap terminal is electrically connected to the second engine-side connector terminal. A first battery is electrically connected to the starter motor. The method comprises disconnecting the cap from the engine-side connector, and connecting the battery-side connector to the engine-side connector such that the battery-side connector covers the first, second and third engine-side connector terminals. The first battery-side connector terminal is electrically connected to the first engine-side connector terminal. The second battery-side connector terminal is electrically connected to the third engine-side connector terminal.

In some implementations of the present technology, the outboard engine also has a cowling defining an engine compartment and a rigging area. The cowling has a cover defining at least in part the rigging area. The engine, the generator and the starter motor are disposed in the engine compartment. The engine-side connector and the cap are disposed in the rigging area. The method further comprises removing the cover from a remainder of the cowling to reveal the rigging area prior to disconnecting the cap from the engine-side connector, and connecting the cover to the remainder of the cowling after connecting the battery-side connector to the engine-side connector.

According to one aspect of the present technology, there is provided an electrical system kit for connecting a battery to an outboard engine. The kit has an engine-side connector, a cap,

and a battery-side connector assembly. The engine-side connector has first, second and third engine-side connector terminals. The first engine-side connector terminal is adapted for electrically connecting to a generator of the outboard engine. The second engine-side connector terminal is adapted for electrically connecting to a starter motor of the outboard engine. The third engine-side connector is adapted for electrically connecting to ground. The cap is adapted for connecting to the engine-side connector and for covering at least the first and second engine-side connector terminals. The cap has first and second cap terminals. The first cap terminal is electrically connected to the second cap terminal. The first cap terminal is adapted for electrically connecting to the first engine-side connector terminal. The second cap terminal is adapted for electrically connecting to the second engine-side connector terminal. The battery-side connector assembly has a battery-side connector, a first battery cable and a second battery cable. The battery-side connector is adapted for connecting to the engine-side connector and for covering the first, second and third engine-side connector terminals. The battery-side connector has first and second battery-side connector terminals. The first battery-side connector terminal is adapted for electrically connecting to the first engine-side connector terminal. The second battery-side connector terminal is adapted for electrically connecting to the third engine-side connector terminal. The first battery cable has a first end electrically connected to the first battery-side connector terminal and a second end adapted for electrically connecting to a first terminal of the battery. The second battery cable has a first end electrically connected to the second battery-side connector terminal and a second end adapted for electrically connecting to a second terminal of the battery.

For purposes of this application, terms related to spatial orientation such as forward, rearward, left, right, vertical, and horizontal are as they would normally be understood by a driver of the watercraft sitting thereon in a normal driving position with the outboard engine in an upright position and steered in a straight ahead direction. Also, for the purposes of this application, electrical values and measurements, such as for voltage and current, are to be understood, where appropriate, as nominal values and that operating values may vary. For instance, it will be appreciated that a fully charged "12-volt" battery is likely to have a potential difference of 13 to 14 volts. Similarly, a circuit meant for charging such a "12-volt" battery will typically provide 13 to 14 volts.

Embodiments of the present technology each have at least one of the above-mentioned aspects, but do not necessarily have all of them. It should be understood that some aspects of the present technology that have resulted from attempting to attain the above-mentioned object may not satisfy this object and/or may satisfy other objects not specifically recited herein.

Additional and/or alternative features, aspects, and advantages of embodiments of the present technology will become apparent from the following description, the accompanying drawings, and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the present technology, as well as other aspects and further features thereof, reference is made to the following description which is to be used in conjunction with the accompanying drawings, where:

FIG. **1** is a left side elevation view of an outboard engine installed on a watercraft partially shown in cross-section;

FIG. **2** is a perspective view taken from a front, left side of a cowling and midsection of the outboard engine of FIG. **1**;

FIG. **3** is a partially cut-away perspective view, taken from a front, right side of a portion of the outboard engine of FIG. **1** with the right side of the cowling being cut away to show a power head, including an engine and a flywheel assembly, housed inside the engine compartment formed by the cowling;

FIG. **4** is a partially exploded view of the cowling and midsection of FIG. **2**;

FIG. **5** is a close-up perspective view taken from a front, left side of an upper portion of the cowling of FIG. **2**, with a top and front covers removed;

FIG. **6** is a top plan view of the front portion of the cowling of FIG. **2**, with the top and front covers removed;

FIG. **7** is a perspective view taken from a front, right side of part of a front portion of a support structure of the cowling of FIG. **2** showing lines extending from a grommet of the cowling;

FIG. **8** is a schematic diagram of an electrical system of the outboard engine of FIG. **1** with a single battery connected thereto; and

FIG. **9** is a schematic diagram of the electrical system of FIG. **8** with two batteries connected thereto.

DETAILED DESCRIPTION

With reference to FIGS. **1** to **3**, an outboard engine **10** has a cowling **100** protecting an engine **20** (shown schematically in FIG. **1**) and other components connected to the engine **20**. The engine **20** and related components connected thereto are collectively referred to herein as a power head **21** (shown in FIG. **3**).

The engine **20** is housed in an engine compartment **102** (FIG. **3**) formed by the cowling **100**. The engine **20** is a direct injection, two-stroke, V-type, six-cylinder internal combustion engine. It is contemplated that other types of engines could be used, such as, but not limited to, carbureted engines, semi-direct injection engines, or four-stroke engines.

As can be seen in FIG. **1**, the outboard engine **10** is mounted to a transom of a boat by a mounting bracket assembly, including a stern bracket **12** and a swivel bracket **14**. The swivel bracket **14** connects the stern bracket **12** to the cowling **100**, and the stern bracket **12** mounts the outboard engine **10** to the transom of a boat **15**. The swivel bracket **14** partly houses a steering shaft (not shown) of the outboard engine **10**. The brackets **12**, **14** can take various forms, the details of which are conventionally known and will therefore not be discussed further herein.

The engine **20** is coupled to a vertically oriented driveshaft **22** (shown schematically). The driveshaft **22** is coupled to a drive mechanism **24** (shown schematically), which includes a transmission **26** (shown schematically) and a bladed rotor, such as a propeller **28** mounted on a propeller shaft **30**. The propeller shaft **30** is generally perpendicular to the driveshaft **22**, but could be at other angles. The drive mechanism **24** could also include a jet propulsion device, turbine or other known propelling device. The bladed rotor **28** could also be an impeller. The drive mechanism **24** and a portion of the propeller shaft **30** are housed within a gear case **38** of the outboard engine **10**.

An exhaust system **32** is connected to the engine **20**. The exhaust system **32** is surrounded by the cowling **100**. A lower portion of the exhaust system **32** is housed in a midsection **34** below the cowling **100** and above the gear case **36**.

With reference to FIG. **3**, the engine **20** has a cylinder block **38** with two banks of three cylinders arranged to form a V. It is contemplated that the cylinder block **38** could have more or less than six cylinders. It is also contemplated that the cylin-

ders could have a configuration other than a V-formation. For example, the cylinders could be arranged inline, in which case the engine **20** would be an inline-type engine. A crankcase **40** is connected to the cylinder block **38**. A crankshaft (not shown) is rotatably disposed inside the crankcase **40**. The bottom end of the crankshaft extends out through a bottom wall of the crankcase **40** to be operatively connected to the driveshaft **22**. Fuel injectors **42** supply fuel to the combustion chambers defined in the cylinders. Spark plugs (not shown) ignite the fuel-air mixture in the combustion chambers.

An air intake system **44**, including a throttle body **46** and a plenum **48**, is connected to the crankcase **40** to supply air for the combustion process. The throttle body **46** has a throttle body inlet **50**. Air enters via the throttle body inlet **50** into the throttle body **46**. A throttle valve regulates the amount of air flowing through the throttle body **46** into the plenum **48** and eventually into the combustion chamber of each cylinder.

A generator **52** (FIG. **8**) and a flywheel (not shown) are located at the top end of the crankcase **40** and connected directly to the top end of the crankshaft of the engine **20**. The generator **52** generates electricity as it turns during operation of the engine **20** as will be described below. A cover **54** is placed over the generator **52** and the flywheel.

An engine management module (EMM) **58** (FIG. **3**) is disposed inside the engine compartment **102**. The EMM **58** controls operation of the engine **20**. The EMM **58** is in electronic communication with various sensors from which it receives signals, such as temperature sensors, pressure sensors, crankshaft position sensors and the like. The EMM **58** uses these signals to control the operation of the throttle valve actuator, the ignition system (not shown), and the fuel injectors **42** in order to control the engine **20**.

The EMM **58** also controls the generation and supply of electrical power for the various components of the outboard engine **10** and some components of the boat **15** as will be described in greater detail below. It also contemplated that some functions of the EMM **58** could be split into multiple electronic components.

To start the engine **20**, the EMM **58** causes power to be supplied to a starter motor **60** (FIG. **3**) disposed inside the engine compartment **102**. As can be seen in FIG. **3**, the starter motor **60** is mounted to a right side of the engine **20**. When power is applied to the starter motor **60**, a gear **62** engages a ring gear **64** and the starter motor **60** drives the gear **62** that in turn drives a ring gear **64**. The ring gear **64** is mounted to the flywheel. As the ring gear **64** is turned, the flywheel turns, which turns the crankshaft. As the crankshaft starts to turn, fuel is injected and ignited in the cylinders to cause the engine **20** to start. Once the engine **20** is started, power is no longer supplied to the starter motor **60**, the gear **62** disengages the ring gear **64** and the starter motor **60** no longer drives the gear **62**.

The configuration of the engine **20** and other components of the power head **21**, as described above, is intended to be exemplary. The outboard engine **10** also has other components housed within the engine compartment **102**, such as an oil filter, an oil pump, spark plugs and the like. As it is believed that these components would be readily recognized by one of ordinary skill in the art, further explanation and description of these components will not be provided herein.

As can be seen in FIGS. **1** to **7**, the cowling **100** includes a support structure **104** (FIGS. **3** to **7**)) and a plurality of panels **106**, **108**, **110**, **112**.

The engine **20** is connected to the support structure **104**. The support structure **104** extends across portions of the front, the top and the back of the engine **20**. A bottom of the support structure **104** is open, and connects to the exhaust system **32**. It is contemplated that the support structure **104** could (instead or in addition) be fixed to the swivel bracket **14** and/or the exhaust system **32**. While it is possible to disconnect the support structure **104** from the engine **20**, the support structure **104** stays fixed to the engine **20** during routine use.

The panels **106**, **108**, **110**, **112** are removably connected to the support structure **104**. The panels **106**, **108**, **110**, **112** are a top cover or cap **106**, a front cover **108**, a rear (or back) cover **110**, and left and right side panels **112**. The panels **106**, **108**, **110**, **112** are connected to an exterior of the support structure **104**. The panels **106**, **108**, **110**, **112** with portions of the support structure **104** form an outer surface of the cowling **100**. The panels **106** and **112** provide access to different parts of the engine **20** when removed.

The support structure **104** is made of plastic. It is contemplated that the support structure **105** could be made of metal, of composite material or of a combination of various materials. The panels **106**, **108**, **110**, **112** are each a single molded piece made of the same plastic as the support structure **105**. It is contemplated that the panels **106**, **108**, **110**, **112** could be made of a material other than the one of the support structure **104** and other than a plastic.

As can be seen in FIG. **4**, the support structure **104** includes a central upper portion **114** and a central front portion **116** connected thereto. The support structure **104** also includes left and right panels **118** connected to the central upper and front portions **114**, **116**. Sound absorbing foam **120**, some of which is shown in FIGS. **4** to **6**, is disposed between the panels **118** and the portions **114**, **116**.

Right and left grommets **122**, **124** are inserted in apertures in the front portion **116** of the support structure **104** near a top thereof. The grommets **122**, **124** have four apertures to receive four lines. The lines can be electric lines (i.e. wires or cables), fluid lines (i.e. fuel lines, oil lines, hydraulic lines, etc.) or mechanical lines (i.e. push-pull cables and the like). The grommets **122**, **124** permit the passage of the lines through the front portion **116**, from components inside the engine compartment **102** to components outside the engine compartment **102**. The grommets **122**, **124** are made of a resilient material so as to reduce the entry of water inside the engine compartment **102**. When the panels **106**, **108** are removed from the cowling **100**, the fronts of the panels **118** partially hide the grommets **122**, **124** from view. The grommet **122** will be described in greater detail below.

Positive and negative battery connection terminals **126**, **128** are provided in the front portion **116** of the support structure **104** near a top thereof. The battery connection terminals **126**, **128** permit the connection of a battery **200** (FIG. **1**) as will be described in greater detail below. The battery connection terminals **126**, **128** are disposed on either side of a separating wall **129**. The wall **129** helps prevent contact between the ends of the battery cables **202** and **204** (FIG. **6**) during their connections to the battery connection terminals **126**, **128** as will be described below.

An oil filling opening, closed by an oil cap **130** is provided at a front, right of the central upper portion **114** of the support structure **104**. The oil filling opening permits the filling of the oil tank of the engine **20**. An aperture **132** is provided in the central upper portion **114** to permit access to the top of the engine **20** for maintenance purposes. The aperture **132** is generally aligned with the crankshaft of the engine. A cap **134** closes the aperture **132** to prevent the entry of water in the engine compartment **102**.

The left panel **118** defines air outlets **136** for expelling air from inside the cover **54**. Both panels **118** define rear side air inlets **138** for supplying air to the throttle body **46**. A main air

inlet **140** is defined on a rear of the cowling **100** between the rear panel **110** and the top cap **106** for supplying air to the throttle body **46**.

The panels **118** form side apertures that reveal portions of the power head **21**. The portions of the power head **21** revealed by the side apertures are selectively covered by the side covers **112** secured by a plurality of connectors, such a quarter-turn screws. It is also contemplated that the side covers **112** could be mounted to the structural panels **118** via other means, for example by friction fit, snaps or latches. Water tight connection between the panels **118** and the side covers **112** is ensured by seals disposed on the side covers **112** and adapted to contact with rims of the lateral side apertures of the panels **118**. The side covers **112** are larger than their corresponding lateral apertures of the panels **118** so as to cover a portion of the panels **118** and provide an additional barrier to prevent water from entering into the engine compartment **102**. The left and right side covers **112** may be removed to access the power head **21** for maintenance and/or servicing. The left and right panels **118** are bolted to each other at various connection points in the front and the back. It is contemplated that the panels **118** could be secured to each other, other than by bolts, and that a seal could be disposed along the connection seam between the panels **118**.

The top cap **106** covers the central upper portion **114**, the aperture **132**, the cap **134** and the oil cap **130**. A downwardly extending front portion **141** of the top cap **106** also covers the grommets **122**, **124** and the battery connection terminals **126**, **128**. The top cap **106** is removably attached to the support structure **104**. As can be seen in FIG. **3**, a latch **142** on the inner surface of the top cap **106** engages a post **144** extending from the upper central portion **114** to removably attach the top cap **106** to the support structure **104**. The latch **142** can be accessed via the air inlet **140**.

With reference to FIGS. **4** to **6**, the front cover **108** is fastened to the central front portion **116** and each of the left and right panels **112**. Fasteners **144** are inserted laterally into the panels **112** and the bottom of the front cover **108**. Fasteners (not shown) are inserted into apertures **146** in the top of the front cover **108** and into apertures **148** in the central front portion **116**. The front portion **141** of the top cap **106** is then attached over the front cover **108** by a pair of friction pins (not shown) and covers the fasteners inserted in the apertures **146**, **148**. The space defined between the front cover **108**, the front portion **141** of the top cap **106** and the central front portion **116** is referred to herein as a rigging area **150** (FIG. **3**). The rigging area **150** permits the passage of lines outside the engine compartment **102** and the connection between various lines outside the engine compartment while shielding and partially hiding these lines and connections. The bottom of the rigging area **150** is opened to permit the passage of the lines. As will be described below, the presence of such a rigging area **150** facilitates the rigging of the outboard engine **10** (the connection of lines between the outboard engine **10** and the boat **15** to which it is being mounted. It is contemplated that the rigging area **150** could be provided between other panels of the cowling **100** or could be a box mounted to the cowling **100**.

The back cover **110** covers a rear portion of the vertical connection seam between the panels **118** so as to provide an additional barrier to water and external elements. The upper end of the back cover **110** is bolted to the rear wall of the upper central portion **114** and the lower end of the back cover **110** is clipped to the panels **118**.

A rigging box **152** (FIG. **1**) is mounted on top of the swivel bracket **14** below the rigging area **150**. As the outboard engine **10** is tilted or trimmed, the rigging box **152** moves together with the swivel bracket **14** and the rest of the outboard engine **10**. As the outboard engine **10** is steered, the rigging box **152** remains fixed to the swivel bracket **14** and the rest of the outboard engine **10**, including the cowling **100**, pivots relative to the rigging box **152**. The rigging box **152** has a top opening (not shown), two side openings (not shown) and defines another rigging area therein. Lines, such as electrical cables or fluid lines, extend from a bottom opening of the rigging area **150**, enter the rigging box **152** through the top opening of the rigging box **152**, exit the rigging box **152** through one of the side openings of the rigging box **152** and then connect to a component in the boat **15**. It is also contemplated that others lines, such as electrical cables or fluid lines, could extend from a bottom opening of the rigging area **150**, enter the box through the top opening of the rigging box **152**. These lines are then connected to other lines inside the rigging area of the rigging box **152** and these other lines exit the rigging box **152** through one of the side openings of the rigging box **152** and then connect to a component in the boat **15**. Lines exiting the rigging box **152** through one of the side openings of the rigging box **152** are disposed inside a tube such as the tube **154** (FIG. **1**). It is contemplated that the tube **154** could be omitted and that the lines could be bundled together by tie wraps for example.

It is contemplated that the rigging area **150** or the rigging area defined inside the rigging box **152** could be omitted.

Turning now to FIGS. **6** and **7**, the right grommet **122** and lines passing therethrough will be described. The grommet **122** has four apertures **156**, **158**, **160**, **170**.

The upper right aperture **156** has a fuel line **162** extending therethrough. A first end (not shown) of the fuel line **162** is connected to a fuel pump (not shown) of the engine **20** inside the engine compartment **102**. From its first end, the fuel line **162** extends inside the engine compartment **102**, passes through the aperture **156** of the grommet **122** and extends inside the rigging area **150**. The second end of the fuel line **162** is disposed inside the rigging area **150** and is provided with a male connection fitting **164**. A second fuel line (not shown) having a corresponding female connection fitting is connected to the male connection fitting **164** inside the rigging area **150**. To connect the second fuel line to the fuel line **162**, the covers **106**, **108** first have to be removed to provide access to the rigging area **150**. From its connection with the fuel line **162**, the second fuel line extends out of the rigging area **150** through a bottom thereof, passes through the rigging box **152** and the tube **154** and then fluidly connects to a fuel tank (not shown) disposed inside the boat **15**. It is contemplated that the second fuel line could extend through the other side opening of the rigging box **152**.

The upper left aperture **158** has an electric cable **166** extending therethrough. A first end (not shown) of the electric cable **166** is connected to the EMM **58** inside the engine compartment **102**. From its first end, the electric cable **166** extends inside the engine compartment **102**, passes through the aperture **158** of the grommet **122** and extends inside the rigging area **150**. From the rigging area **150**, the electric cable **166** passes through a passage **168** (FIG. **6**) defined in the foam **120** between the right panel **118** and the front portion **116** of the support structure **104**. A second end of the electric cable **166** is provided with a tilt/trim switch connector **170**. The tilt/trim switch connector **170** is connected to a tilt/trim switch **172** (FIG. **6**) disposed on a front right side of the cowling **100**. When a user actuates the tilt/trim switch **172**, signals from the switch **172** are sent to the EMM **58** via the electric cable **166**. The EMM **58** then sends signals to cause one or more hydraulic actuators to tilt or trim the swivel bracket **14** in response to the signals from the switch **172**.

The lower left aperture **160** has auxiliary oil line **174** extending therethrough. A first end (not shown) of the auxiliary oil line **174** is connected to an oil pump (not shown) of the engine **20** inside the engine compartment **102**. From its first end, the auxiliary oil line **174** extends inside the engine compartment **102**, passes through the aperture **160** of the grommet **122** and extends inside the rigging area **150**. The second end of the auxiliary oil line **174** is disposed inside the rigging area **150** and is provided with a male connection fitting **176**. The auxiliary oil line **174** is used when an oil tank (not shown) is provided in the boat **15**. Such an oil tank is usually provided inside the boat **15** when it would be inconvenient for the user to refill the oil tank of the outboard engine **20** via the oil filling opening, which is closed by cap **130**, provided in the top of the support structure **104**.

When no connection to an auxiliary oil tank is necessary, the male connection fitting **176** is closed by a cap **178** as shown in FIG. **7** and the auxiliary oil line **174** is routed between the right panel **118** and the front portion **116** of the support structure **104** so as to be at least partially hidden when removing the front cover **108** and to prevent the auxiliary oil line **174** from moving around inside the rigging area **150**.

When an auxiliary oil tank is provided inside the boat **15**, the cap **178** is removed and a second auxiliary oil line (not shown) having a corresponding female connection fitting is connected to the male connection fitting **176** inside the rigging area **150**. To connect the second auxiliary oil line to the auxiliary oil line **174**, the covers **106**, **108** first have to be removed to provide access to the rigging area **150**. From its connection with the auxiliary oil line **174**, the second auxiliary oil line extends out of the rigging area **150** through a bottom thereof, passes through the rigging box **152** and the tube **154** and then fluidly connects to the auxiliary oil tank disposed inside the boat **15**. It is contemplated that the second auxiliary oil line could extend through the other side opening of the rigging box **152**.

The lower right aperture **162** has electric cables **206**, **208**, **210** extending therethrough. The electric cables **206**, **208**, **210** are disposed inside a sheath **180**. First ends of the electric cables **206**, **208**, **210** are connected to components inside the engine compartment **102** as will be described below. From their first ends, the electric cables **206**, **208**, **210** extend inside the engine compartment **102**, pass through the aperture **162** of the grommet **122** and extend inside the rigging area **150**. The second ends of the electric cables **206**, **208**, **210** are disposed inside the rigging area **150** and are connected to an engine-side connector **212** also disposed inside the rigging area **150**. It should be understood, that the term "engine-side" of engine-side connector **212** refers to the side of a connection provided by the connector **212** (i.e. it connects to components of the engine **20**) and not to a particular spatial position of the connector **212**. The auxiliary electric cables **206**, **208**, **210** and the engine-side connector **212** are used to facilitate the connection of an auxiliary battery **214** (FIG. **1**) provided in the boat **15**. Such an auxiliary battery **214** is usually provided inside the boat **15** when the boat **15** has accessories that need to be powered, such as a trolling motor, a fish finder, a GPS, a live well, a refrigerator, bilge pumps and a sound system for example. An auxiliary battery **214** can also be provided as a backup to the battery **200** used for starting the engine **20**.

When no auxiliary battery **214** is provided, a cap **216** is connected to the engine-side connector **212** as shown in FIG. **7**. The cap **216** is held in place by a clip **218** provided on the engine-side connector **212**. The cap **216** is disposed inside the rigging area **150**. The electric cables **206**, **208**, **210**, the connector **212** and the cap **216** are arranged between the right panel **118** and the front portion **116** of the support structure **104** so as to be at least partially hidden when removing the front cover **108** and to prevent them from moving around inside the rigging area **150**.

When an auxiliary battery **214** is provided inside the boat **15**, the cap **216** is disconnected from the engine side connector **212** and a battery-side connector **220** (FIG. **9**) is connected to the engine-side connector **212** inside the rigging area **150**. The battery-side connector **220** is held in place by the clip **218** of the engine-side connector **212**. The battery-side connector **220** is connected to two battery cables **222**, **224** (FIG. **1**). It should be understood, that the term "battery-side" of battery-side connector **220** refers to the side of a connection provided by the connector **220** (i.e. it connects to the battery **214**) and not to a particular spatial position of the connector **220**. To connect the battery-side connector **220** to the engine-side connector **212**, the covers **106**, **108** first have to be removed to provide access to the rigging area **150**. The covers **106**, **108** are then reconnected to the rest of the cowling **100** once the battery-side connector **220** is connected to the engine-side connector **212**. The battery cables **222**, **224** extend out of the rigging area **150** through a bottom thereof, pass through the rigging box **152** and the tube **154** and then connect to the auxiliary battery **214** disposed inside the boat **15**. It is contemplated that the battery cables **222**, **224** could extend through the other side opening of the rigging box **152**. It is contemplated that the auxiliary battery **214** could not be disposed inside the boat **15**. For example, the auxiliary battery **214** could be disposed on the stern or swivel brackets **12**, **14**. It is contemplated that the auxiliary battery **214** could be provided elsewhere outside of the engine compartment **102**.

Turning now to FIGS. **8** and **9**, an electrical system for the outboard engine **10** will be described. The voltages (in volts, V) and amperages (in amperes, A) provided below are exemplary values of particular implementation of the electrical system. It should be understood that other values are contemplated. Also, ranges of amperages are provided below. It should be understood that the actual value of amperage within such a range at a particular time depends on the total power demand at that particular time or the power requirement of a particular connection at that particular time.

As can be seen in FIGS. **8** and **9**, the generator **52** is electrically connected to the EMM **58** to supply direct current to the EMM **58**. It is contemplated that the generator **52** could be a magneto or an alternator generating alternating current coupled to a rectifier converting the alternating current to direct current. Other types of generators, such as dynamos, are also contemplated. The generator **52** supplies up to 20 A of direct current at 55V. It is contemplated that the generator **52** could supply alternating current to the EMM **58** which would then integrate the functions of a rectifier in order to then supply direct current. The amount of power supplied by the generator **52** depends on the speed of rotation of the crankshaft of the engine **20** to which the generator is coupled. The EMM **58** divides the power received from the generator **52** between multiple ports **226**, **228**, **230**.

The port **226** is representative of a plurality of ports that are electrically connected to a plurality of electrical components **232** of the engine **20** and other electrical components of the outboard engine **10**. These include, but are not limited to, the fuel pump, the oil pump, the fuel injectors **42**, the throttle valve and the hydraulic pumps for tilting, trimming and steering the outboard engine **10**. The EMM **58** supplies up to 10 A of direct current at 12V to the electrical components **232** via the port **226**.

The port **228** is electrically connected to the positive terminal of the starter motor **60** and to the battery connection terminal **126**. The battery cable **202** is electrically connected

at one end to the battery connection terminal **126** by a ring connector (not shown). It is contemplated that the ring connector could be replaced by any type of connector suitable to the type of battery connection terminal **126** provided. The other end of the battery cable **202** is electrically connected to the positive terminal of the battery **200**. The battery cable **204** is connected at one end to the negative terminal of the battery **200**. The other end of the battery cable **204** is electrically connected to the battery connection terminal **128** by a ring connector (not shown). It is contemplated that the ring connector could be replaced by any type of connector suitable to the type of battery connection terminal **128** provided. The battery connection terminal **128** is connected to ground **234** inside the engine compartment. The negative terminal of the starter motor **60** is also connected to ground **234**. As such, the battery **200** can supply power to the starter motor **60** in order to start the engine **20**. The EMM **58** supplies between 15 A and 25 A of direct current at 12V to the battery **200** to recharge the battery **200**. It is contemplated that the battery **200** could also supply power to the EMM **58** via the port **228**, or another port, for the EMM **58** to redistribute this power should the power generated by the generator **52** be insufficient. It is also contemplated that the battery **200** could be multiple batteries **200** connected in series or parallel. It is also contemplated that the battery connection terminals **126**, **128** could be omitted. In one example of such an implementation, the battery cable **202** is connected between the starter motor **60** and the battery **200** and the battery cable **204** is connected between the battery **200** and ground **234**. In this example, the battery cables **202**, **204** pass through the front portion **116** of the support structure **104** and grommets are provided in the front portion **116** around the cables **202**, **204**.

As can be seen in FIGS. **8** and **9**, the engine-side connector **212** has three engine-side connector terminals **236**, **238**, **240**. The electrical cable **206** is electrically connected between the port **230** of the EMM **58** and the terminal **236**. The EMM **58** supplies 25 A of direct current at 12V to the terminal **236**. The electrical cable **208** is electrically connected between the terminal **238** and the positive terminal of the starter motor **60**. Therefore, the terminal **238** is electrically connected to the positive terminal of the battery **200**. The electrical cable **210** is electrically connected between the terminal **240** and ground **234**.

As discussed above, when no auxiliary battery **214** is provided, as in FIG. **8**, the cap **216** is connected to the engine-side connector **212**. The cap **216** has two cap terminals **242**, **244**. The two cap terminal **242**, **244** are electrically connected to each other by an electrical cable **246**. As can be seen in FIG. **7**, the cable **246** is disposed in part externally of the cap **216**. It is contemplated that the two terminals **242**, **244** could be connected to each other via a connection that is provided inside the cap **216**. When the cap **216** is connected to the engine-side connector **212**, the cap terminal **242** is electrically connected to the connector terminal **236** and the cap terminal **244** is electrically connected to the connector terminal **238**. The cap **242** therefore provides an electrical connection between the port **230** of the EMM **58** and the positive terminal of the battery **200**. As such, when no auxiliary battery **214** is provided and the cap **216** is connected to the engine-side connector **212**, power from both ports **228**, **230** of the EMM **58** is used to recharge the battery **200**. In the present implementation, battery **200** can therefore be recharged by a direct current between 40 A and 50 A at 12V flowing from the battery connection terminal **126** to the positive terminal of the battery **200**. In the implementation shown, the cap **212** covers all three terminals **236**, **238**, **240** of the connector **212**. It is contemplated that the cap **212** could only cover the terminals **236**, **238** of the connector **212**.

As discussed above, when an auxiliary battery **214** is provided, as in FIG. **9**, the battery-side connector **220** is electrically connected to the engine-side connector **212**. Although not shown, the auxiliary battery **214** is electrically connected to electrical components of the boat **15** to supply power to them. In the present implementation, the auxiliary battery **214** is what is commonly referred to as a deep-cycle battery, but other types of batteries are contemplated. The battery-side connector **220** has two battery-side connector terminals **248**, **250**. The battery cable **222** is electrically connected between the terminal **248** and the positive terminal of the auxiliary battery **214**. The battery cable **224** is electrically connected between the negative terminal of the auxiliary battery **214** and the terminal **250**. The battery-side connector terminal **248** is electrically connected to the engine-side connector terminal **236**. When the battery-side connector **220** is connected to the engine-side connector **212**, the battery-side connector terminal **250** is electrically connected to the engine-side connector terminal **240**. As such, the connectors **212**, **220** provide an electrical connection between the port **230** of the EMM **58** and the positive terminal of the auxiliary battery **214** and an electrical connection between the negative terminal of the auxiliary battery **214** and ground **234**. As such, when the auxiliary battery **214** is provided and the connectors **212**, **220** are connected to each other, the auxiliary battery **214** is recharged by a 25 A direct current at 12V from the port **230** of the EMM **58** and the battery **200** is recharged by a 15 A to 25 A direct current at 12V from the port **228** of the EMM **58**. The battery-side connector **220** covers all three terminals **236**, **238**, **240** of the engine-side connector **212**. It is contemplated that the auxiliary battery **214** could be multiple auxiliary batteries **214** connected in series or parallel.

It is contemplated that the engine-side connector **212**, the cap **216** and the battery-side connector **220** with the battery cables **222**, **224** could be provided as a kit to be used for retrofitting the electrical system of outboard engines that do not have the electrical system described above. It is contemplated that the kit could also include the cables **206**, **208**, **210**.

Modifications and improvements to the above-described embodiments of the present technology may become apparent to those skilled in the art. The foregoing description is intended to be exemplary rather than limiting. The scope of the present technology is therefore intended to be limited solely by the scope of the appended claims.

What is claimed is:

1. An electrical system for an outboard engine comprising:

a generator;

a starter motor electrically connected to ground;

a connector having first, second and third connector terminals, the first connector terminal being electrically connected to the generator, the second connector terminal being electrically connected to the starter motor, and the third connector terminal being electrically connected to ground;

a battery electrically connected to the starter motor and the second connector terminal;

an engine management module (EMM) electrically connected to the generator and to the first connector terminal, the generator being electrically connected to the first connector terminal via the EMM; and

a cap connected to the connector and covering at least the first and second connector terminals, the cap having first and second cap terminals, the first cap terminal being electrically connected to the first connector terminal, the first cap terminal being electrically connected to the

second cap terminal, and the second cap terminal being electrically connected to the second connector terminal.

2. The electrical system of claim **1**, wherein the EMM is electrically connected to the first connector terminal by a first connection; and

wherein the EMM is electrically connected to the starter motor by a second connection.

3. The electrical system of claim **2**, wherein the generator is electrically connected to the starter motor via the EMM and the second connection.

4. An outboard engine comprising:

an internal combustion engine;

a driveshaft operatively connected to and driven by the engine;

a propeller shaft operatively connected to and driven by the driveshaft;

a propeller connected to and driven by the propeller shaft; and

the electrical system of claim **1**,

the generator being connected to and driven by the engine, and

the starter motor being selectively operatively connected to the engine for starting the engine.

5. The outboard engine of claim **4**, further comprising a cowling defining an engine compartment;

wherein the engine, the generator and the starter motor are disposed in the engine compartment; and

wherein the connector and the cap are disposed outside the engine compartment.

6. The outboard engine of claim **5**, wherein the cowling defines a rigging area; and

wherein the connector and the cap are disposed in the rigging area.

7. The outboard engine of claim **6**, wherein the battery is disposed outside of the cowling.

8. An electrical system for an outboard engine comprising:

a generator;

a starter motor electrically connected to ground;

an engine-side connector having first, second and third engine-side connector terminals, the first engine-side connector terminal being electrically connected to the generator, the second engine-side connector terminal being electrically connected to the starter motor, and the third engine-side connector terminal being electrically connected to ground;

a battery-side connector connected to the engine-side connector and covering the first, second and third engine-side connector terminals, the battery-side connector having first and second battery-side connector terminals, the first battery-side connector terminal being electrically connected to the first engine-side connector terminal, and the second battery-side connector terminal being electrically connected to the third engine-side connector terminal; and

a battery having a first terminal electrically connected to the first battery-side connector terminal and a second terminal electrically connected to the second battery-side connector terminal.

9. The electrical system of claim **8**, wherein the battery is a first battery; and

further comprising a second battery electrically connected to the starter motor.

10. The electrical system of claim **9**, further comprising an engine management module (EMM) electrically connected to the generator and to the first engine-side connector terminal; and

wherein the generator is electrically connected to the first engine-side connector terminal via the EMM.

11. The electrical system of claim **10**, wherein the EMM is electrically connected to the first engine-side connector terminal by a first connection; and

wherein the EMM is electrically connected to the starter motor by a second connection.

12. The electrical system of claim **11**, wherein the generator is electrically connected to the starter motor via the EMM and the second connection.

13. An outboard engine comprising:

an internal combustion engine;

a driveshaft operatively connected to and driven by the engine;

a propeller shaft operatively connected to and driven by the driveshaft;

a propeller connected to and driven by the propeller shaft; and

the electrical system of claim **8**,

the generator being connected to and driven by the engine, and

the starter motor being selectively operatively connected to the engine for starting the engine.

14. The outboard engine of claim **13**, further comprising a cowling defining an engine compartment;

wherein the engine, the generator and the starter motor are disposed in the engine compartment; and

wherein the engine-side connector, the battery-side connector and the battery are disposed outside the engine compartment.

15. The outboard engine of claim **14**, wherein the cowling defines a rigging area; and

wherein the engine-side connector and the battery-side connector are disposed in the rigging area.

16. The outboard engine of claim **15**, wherein the battery is a first battery; and

further comprising a second battery electrically connected to the starter motor, the first and second batteries being disposed outside of the cowling.

17. A method for connecting a second battery to an outboard engine,

the second battery having a first terminal electrically connected to a first battery-side connector terminal of a battery-side connector and a second terminal electrically connected to a second battery-side connector terminal of the battery-side connector,

the outboard engine having:

an internal combustion engine;

a driveshaft operatively connected to and driven by the engine;

a propeller shaft operatively connected to and driven by the driveshaft;

a propeller connected to and driven by the propeller shaft; and

a generator connected to and driven by the engine;

a starter motor selectively operatively connected to the engine for starting the engine and electrically connected to ground;

an engine-side connector having first, second and third engine-side connector terminals, the first engine-side connector terminal being electrically connected to the generator, the second engine-side connector terminal being electrically connected to the starter motor, and the third engine-side connector terminal being electrically connected to ground;

a cap connected to the engine-side connector and covering at least the first and second engine-side connec-

tor terminals, the cap having first and second cap terminals, the first cap terminal being electrically connected to the first engine-side connector terminal, the first cap terminal being electrically connected to the second cap terminal, the second cap terminal being electrically connected to the second engine-side connector terminal; and

a first battery electrically connected to the starter motor;

the method comprising:

disconnecting the cap from the engine-side connector; and

connecting the battery-side connector to the engine-side connector such that the battery-side connector covers the first, second and third engine-side connector terminals, the first battery-side connector terminal being electrically connected to the first engine-side connector terminal, and the second battery-side connector terminal being electrically connected to the third engine-side connector terminal.

18. The method of claim **17**, wherein the outboard engine also has a cowling defining an engine compartment and a rigging area, the cowling having a cover defining at least in part the rigging area;

wherein the engine, the generator and the starter motor are disposed in the engine compartment; and

wherein the engine-side connector and the cap are disposed in the rigging area;

the method further comprising:

removing the cover from a remainder of the cowling to reveal the rigging area prior to disconnecting the cap from the engine-side connector; and

connecting the cover to the remainder of the cowling after connecting the battery-side connector to the engine-side connector.

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